



SUBSTITUTE SEQUENCE LISTING

<110> Mitsukan Group Corporation  
Goto, Hidetsugu

<120> Structural gene responsible for high temperature tolerance in acetic acid bacteria, acetic acid bacteria transformed with said gene, and acetic acid fermentation using said transformants.

<130> 271245US0PCT

<140> 10/538,481

<141> 2003-12-04

<150> PCT/JP03/15542

<151> 2003-12-04

<150> JAPAN 2002-356844

<151> 2002-12-09

<160> 7

<210> 1

<211> 1313

<212> DNA

<213> Gluconacetobacter entanii

<400> 1

```
gaagagtgat attacacttc cctgacgccg ttttctaatt tgctccatac gcggggacctt      60
gccggaaaga taatgtctgt tttcaacgct cttgtttcac ccgccggact ggccgcgacc      120
gttgccggtcg ccgggtgcat gcaggcagcg cttggcactt ttctgggtctc gcgtttccgg      180
tggcaggaaa aacgcattgga ccggggcggtg cccatgcctc cggtttccgt gctcaagccc      240
ctccacggcg atgaaccgct gctggaggaa gcgcttgaaa gcttctgcac gcaggattac      300
ccgcagatgc agatcgtctt tggcgtacag gccgaagacg atgcggcgat cccgatcgta      360
caacggttga tggaaacgcca cccggatgtg cagatggaac tggtgattga cccaccttc      420
cacgggctca accgcaagat cggcaacctg atcaacatca tgacgcgcgt gaagcatgat      480
gtcctggtca tttccgattc ggatatccac gttgcccccg attacctgcg gcatgtggtg      540
ggcgccatgg tgcccagaaa tgtcggcctg gtcacgacgc tgtacgcggg gctgcccgcg      600
tcatccacgc tgccgcgcct gctggccgca tgccagatca accataactt cctgcccggc      660
gtgatgctgt cactctacct cgggcggcag gactgccttg gggcgacaat ggcgctgcgg      720
cgttccatgc tggacgaaat cggcgggctg gaagccctcg tgccgcgatg ggccgatgat      780
gcgatactgg gccgttacgt gcgtgaccgt ggcaaggata tcgccattgc cgcgtgcatg      840
acctggacca ccgtgggcga gacctcgatg cgtgaggtgc tggcgcatga actgcgctgg      900
ggccggaccg tcaagacgct ggagcctgcg ggttatgccg catccgccat ccagctgccc      960
ctgttctggg ccagcgtcgc cgtgcttgcc gcgcgcgatg cgacctggac atggtccttc     1020
tttcttggtg catggggatg gcgggcccgtg tgttccttca tcctggaccg tacgtggtg      1080
caacgtagtc tgggtgctgcc gtcactgctt ctgccactgc gcgactggat ctcgcccgcc      1140
gtcatggtgg gcagtgtcac tggcacgcgg gttgcatggc gtgggcagac aatgcatgtc      1200
acgccccatt cggatcatgac accacgatcg caaccggctt ccccggtga ctgaccgcgc      1260
gtcagcaggg tgaactgctt gagaattcca accctgtcgt taataagaac ggg          1313
```

<210> 2

<211> 393

<212> PRT

<213> Gluconacetobacter entanii

<400> 2

```
Met Ser Val Phe Asn Ala Leu Val Ser Pro Ala Gly Leu Ala Ala Thr
      5          10          15
Val Ala Val Ala Gly Cys Met Gln Ala Ala Leu Gly Thr Phe Leu Val
      20          25          30
Ser Arg Phe Arg Trp Gln Glu Lys Arg Met Asp Arg Ala Val Pro Met
      35          40          45
Pro Pro Val Ser Val Leu Lys Pro Leu His Gly Asp Glu Pro Leu Leu
      50          55          60
Glu Glu Ala Leu Glu Ser Phe Cys Thr Gln Asp Tyr Pro Gln Met Gln
      65          70          75          80
Ile Val Phe Gly Val Gln Ala Glu Asp Asp Ala Ala Ile Pro Ile Val
      85          90          95
Gln Arg Leu Met Glu Arg His Pro Asp Val Gln Met Glu Leu Val Ile
      100          105          110
Asp Pro Thr Phe His Gly Leu Asn Arg Lys Ile Gly Asn Leu Ile Asn
      115          120          125
Ile Met Thr Arg Val Lys His Asp Val Leu Val Ile Ser Asp Ser Asp
      130          135          140
Ile His Val Ala Pro Asp Tyr Leu Arg His Val Val Gly Ala Met Val
      145          150          155          160
Pro Asp Asn Val Gly Leu Val Thr Thr Leu Tyr Ala Gly Leu Pro Ala
      165          170          175
Ser Ser Thr Leu Pro Arg Leu Leu Ala Ala Cys Gln Ile Asn His Asn
      180          185          190
Phe Leu Pro Gly Val Met Leu Ser Leu Tyr Leu Gly Arg Gln Asp Cys
      195          200          205
Leu Gly Ala Thr Met Ala Leu Arg Arg Ser Met Leu Asp Glu Ile Gly
      210          215          220
Gly Leu Glu Ala Leu Val Pro His Val Ala Asp Asp Ala Ile Leu Gly
      225          230          235          240
Arg Tyr Val Arg Asp Arg Gly Lys Asp Ile Ala Ile Ala Ala Cys Met
      245          250          255
Thr Trp Thr Thr Val Gly Glu Thr Ser Met Arg Glu Val Leu Ala His
      260          265          270
Glu Leu Arg Trp Gly Arg Thr Val Lys Thr Leu Glu Pro Ala Gly Tyr
      275          280          285
Ala Ala Ser Ala Ile Gln Leu Pro Leu Phe Trp Ala Ser Val Ala Val
      290          295          300
Leu Ala Ala Pro His Ala Thr Trp Thr Trp Ser Phe Phe Leu Gly Ala
      305          310          315          320
Trp Gly Trp Arg Ala Val Cys Ser Phe Ile Leu Asp Arg Thr Leu Ala
      325          330          335
Gln Arg Ser Leu Val Leu Pro Ser Leu Leu Pro Leu Arg Asp Trp
      340          345          350
Ile Ser Ala Ala Val Met Val Gly Ser Val Thr Gly Thr Arg Val Ala
      355          360          365
Trp Arg Gly Gln Thr Met His Val Thr Pro His Ser Val Met Thr Pro
      370          375          380
Arg Ser Gln Pro Ala Ser Pro Gly Asp
      385          390          393
```

<210> 3

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer 1

<400> 3

gaagagtgat attacacttc cctgacgccg

30

<210> 4

<211> 26

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer 2

<400> 4

cccgttctta ttaacgacag ggttgg

26

<210> 5

<211> 5734

<212> DNA

<213> Gluconacetobacter entanii (Acetobacter altoacetigenes MH-24)

<400> 5

catggggcgt	cacccccagc	ggccagcttg	gctacctgat	ggacagggcg	ggccttctgc	60
aagccctcgg	ccactgccat	ctgccgggat	atgaggccaa	atacgaaccg	aaggaaaagc	120
gcaccttctg	ctaccccacc	cagaacgcca	gcggctgggc	tgtgcagcca	tgatcgccaa	180
cccctccctc	ttcctgagca	attcgggaaga	gcgatttccg	ccgactgaac	acgtcgaaaa	240
tggcagtttt	ccaccgaaaa	aaggaaaagga	ccataggaaa	ggattaatat	cttattttta	300
tctagggggt	tgccgatccg	cgattttcgc	tgggaaaccg	ccaaaaatgg	cttgccatta	360
ggtcgcacca	catgcgacca	taaagtcgca	cagtgtgcga	cctattcggc	ccatatacag	420
aggttcccca	catgcggaat	gtcacccgtc	tcaagaccgc	caaagaccgc	ctccgcgagg	480
accaagccga	cctggtgaag	caagcccttc	tgcccttcgc	agaggacgat	ggaccgatgc	540
gggatgcggt	cggacggctc	tacgtccaga	tcaagaacct	caccacccca	gaccccgga	600
ccacggagcc	gttcgtcatg	atccgtcccg	cccagaatcg	cgcgctcacc	ctctggctgc	660
tgaagaacag	taagcgcccc	atgaaggccg	tggacgtatg	gacgctgctg	ttcgaccacc	720
tgtttcccca	taccggccag	atcatgctga	cccgtgagga	aatcgcggaa	aaagtccgta	780
tccgggtcaa	cgaagttaca	gccgtcatga	acgagctggt	gagcttcggc	gcgattttct	840
ccgagcgcca	gaaggtggcc	ggaatgcgcg	ggccgggcct	cgcgcgctac	tacatgaacc	900
ggcatgtggc	cgaggtcggc	agccgcgcca	cgcaggaaga	acttgcccta	atcccacgcc	960
ccggcgccaa	gctggcagtc	gtgcagggtg	gcaaggctta	acccatgaag	gtttcggaac	1020
tggacgtggt	cgacagcgcc	aaggcggcac	aagaccggtt	ggtgcgggaa	gaactgctgc	1080
aagcagcgca	ggcggacggc	cacggccccg	ccctcgtca	tgcccgttcc	gtcatagcca	1140
aggcgcgggc	cgggcaggac	gccaaggctt	aacggccccg	ccctctcccg	cctcgatccc	1200
ggcgggcctg	tagcatctcc	tgatgctcct	tggcggtttt	ggcccgcgtc	tcggcccgc	1260

ctttctcggc	cgctgcggct	cttaggcgct	cttcggccag	ccgcatccgc	tcgtccatct	1320
gacgtttccg	atctgcctcg	gcatccttgg	cggtcctgc	cttcagccct	ttgctgaaag	1380
ccatccactt	attggcgggt	ttctcggtt	tctgctgtat	cggcggggtc	agccggtcaa	1440
atgcctgggc	caccctctcg	aagccctcac	gcatggcggt	gacggcctgc	gccagtttag	1500
ccagggcgaa	atctatcacc	tcggcccgct	gggcgtttct	ggcccgata	cgccggttgt	1560
ggttgccggg	cggggtctgg	tggcccttcc	gttcagagc	caccacattc	ggccccatgt	1620
gocgctctgg	aacgcggtct	agccctgct	ccgcatgtct	ccggtgatct	atccgggcct	1680
cttggcccagc	ccgctctagc	gcggcattgg	caaggcccgc	ccatagctgc	cggatttcct	1740
tcacctcgtc	ggcggccttc	cccagtccca	tgccttgccg	cttcttgctg	gacagttcga	1800
tggttgattt	gtctccaaag	gacagcttgc	cacggccccc	ccgctccacc	gtgcgggtgg	1860
tggtcatgat	gtgcgcgtga	tgattccggg	cgctgccttc	gtcacccgga	agatgcacgg	1920
ccacgtccac	ggccaccccc	taccgctgga	ccaactcacg	cgcgaaactg	tcccgagtt	1980
cgccccgctg	ctcgcgtggtg	agttcatgag	ggaggggccac	aaccattcc	ctcccggtgc	2040
ggcgctcctt	gcgtttctct	gatcgctccg	cgctattcca	caattccgaa	cggtcagcgg	2100
tgccaccccc	cggaatgaaa	attgccttat	gggcaacgct	attctgcctg	gggctgtatt	2160
tgtgttcgtg	cccgtcaacc	tcgttgggtca	aatcctcgcc	agcacgatac	gcagccgcag	2220
ccacaacgga	acgcccctgcy	ctccggctga	tcggtttcgt	ttctgcgcga	tagattgcca	2280
cggatcgagc	gcctaccttt	tggagttaaa	cgggggggttc	aggggggcca	agccaccatg	2340
acgcaggact	tgcacttggtg	caagtcgtaa	ctgcgccttc	aatacctgac	ggcatcaagg	2400
gatagtgggt	attcgtttga	aacggaacgg	ctccacgggtg	aggatgatat	gagcgatatt	2460
gcgaaagaga	ttgagaacgc	caaaaggatc	atagctgaac	agaaaaagcg	catcaaagat	2520
gcccagaagg	aagcagctaa	agcggaatca	aagttgaggg	accgtcagaa	ctacatcttg	2580
ggcggcgcac	tggtaaaact	tgccgaaaca	gatgaacggg	ccgtccgcac	tattgaaaca	2640
cttttgaaagc	tggtggatcg	tccatcagac	cggaaggcgt	ttgagggtgt	ttcccgcttc	2700
ccatccctct	ccctgcccac	gcagccagca	ccggacaccg	gccatgagtg	aggcactgga	2760
agaagatccg	tttgaactgt	tcaaaagggt	cgaaaaaagc	ctgtccacgg	ccaccgccag	2820
catggagcgg	ctggccgcgg	aacaagatgc	caggtgcaag	accatttcag	acgccgcgg	2880
aaaagcctct	aaattggccg	aggaagccgg	tgacaccttc	acagcatcca	agaggcgtct	2940
gatgatctgg	acggccctct	gcgcggctct	gctggctctgt	ggcgggtggg	tggcgggtta	3000
ttggctggga	caccgtgacg	gttgggcctc	tggcacgggc	cacgacgtct	aagaaaccat	3060
tattatcatg	acattaacct	ataaaaaatag	gcgtatcacg	aggccctttc	gtctcgcgcg	3120
tttcgggtgat	gacgggtgaaa	acctctgaca	catgcagctc	ccggagacgg	tcacagcttg	3180
tctgtaagcg	gatgccggga	gcagacaagc	ccgtcagggc	gcgtcagcgg	gtgttggcgg	3240
gtgtcggggc	tggcttaact	atgcggcatc	agagcagatt	gtactgagag	tgcaccatat	3300
gcggtgtgaa	ataccgcaca	gatgcgtaag	gagaaaaatac	cgcatcaggc	gccattcgcc	3360
attcaggctg	cgcaactgtt	gggaaggggc	atcgggtgcgg	gcctcttcgc	tattacgcca	3420
gctggcgaaa	gggggatgtg	ctgcaaggcg	attaagttgg	gtaacgccag	ggttttccca	3480
gtcacgacgt	tgtaaaacga	cggccagtgc	caagcttgca	tgctgcaggg	tcgactctag	3540
aggatccccg	ggtaccgagc	tcgaattcgt	aatcatggtc	atagctgttt	cctgtgtgaa	3600
attgttatcc	gctcacaatt	ccacacaaca	tacgagccgg	aagcataaag	tgtaaagcct	3660
ggggtgccta	atgagtgagc	taactcacat	taattgcgtt	gcgtcactg	cccgttttcc	3720
agtcgggaaa	cctgtcgtgc	cagctgcatt	aatgaatcgg	ccaacgcgcg	gggagaggcg	3780
gtttgcgtat	tgggcgctct	tccgcttcct	cgctcactga	ctcgctgcgc	tcggtcgctc	3840
ggctgcggcg	agcggtatca	gctcactcaa	aggcggtaat	acggttatcc	acagaatcag	3900
gggataacgc	aggaaagaac	atgtgagcaa	aaggccagca	aaaggccagg	aaccgtaaaa	3960
aggccgcggt	gctggcggtt	ttccataggc	tccgcccccc	tgacgagcat	cacaaaaatc	4020
gacgtccaag	tcagagggtg	cgaaacccga	caggactata	aagataccag	gcgtttcccc	4080
ctggaagctc	cctcgctgcg	tctcctgttc	cgaccctgcc	gcttacggga	tacctgtccg	4140
cctttctccc	ttcgggaagc	gtggcgcttt	ctcaatgctc	acgctgtagg	tatctcagtt	4200
cgggtgtaggt	cgttcgctcc	aagctgggct	gtgtgcacga	acccccggtt	cagcccagcc	4260
gctgcgcctt	atccggtaac	tatcgtcttg	agtccaaccc	ggtaagacac	gacttatcgc	4320
cactggcagc	agccactggt	aacaggatta	gcagagcgag	gtatgtaggc	ggtgctacag	4380
agttcttgaa	gtggtggcct	aactacggct	acactagaag	gacagtattt	ggtatctgcg	4440
ctctgctgaa	gccagttacc	ttcggaaaaa	gagttggtag	ctcttgatcc	ggcaaacaaa	4500
ccaccgcgtg	tagcgggtgg	ttttttgttt	gcaagcagca	gattacgcgc	agaaaaaaag	4560
gatctcaaga	agatcctttg	atcttttcta	cggggtctga	cgctcagtg	aacgaaaact	4620
cacgttaagg	gatttttggtc	atgagattat	caaaaaggat	cttcacctag	atccttttaa	4680
attaaaaatg	aagtttttaa	tcaatctaaa	gtatatatga	gtaaaacttg	tctgacagtt	4740
accaatgctt	aatcagtgag	gcacctatct	cagcgatctg	tctatttcgt	tcatccatag	4800
ttgcctgact	ccccgtcgtg	tagataacta	cgatacggga	gggcttacca	tctggcccca	4860
gtgctgcaat	gataccgcga	gaccacgct	caccggctcc	agatttatca	gcaataaacc	4920

agccagccgg	aagggccgag	cgcagaagtg	gtcctgcaac	tttatccgcc	tccatccagt	4980
ctattaattg	ttgccgggaa	gctagagtaa	gtagttcgcc	agttaatagt	ttgcgcaacg	5040
ttgttgccat	tgctacaggc	atcgtggtgt	cacgctcgtc	gtttggtatg	gcttcattca	5100
gctccggttc	ccaacgatca	aggcgagtta	catgatcccc	catgttggtc	aaaaaagcgg	5160
ttagctcctt	cggctcctccg	atcgttggtc	gaagtaagtt	ggccgcagtg	ttatcactca	5220
tggttatggc	agcactgcat	aattctctta	ctgtcatgcc	atccgtaaga	tgcttttctg	5280
tgactgggtga	gtactcaacc	aagtcattct	gagaatagtg	tatgcggcga	ccgagttgct	5340
cttgcccggc	gtcaatacgg	gataataccg	cgccacatag	cagaacttta	aaagtgtc	5400
tcattggaaa	acgttcttcg	gggcgaaaac	tctcaaggat	cttaccgctg	ttgagatcca	5460
ttcgatgtaa	cccactcgtg	cacccaactg	atcttcagca	tcttttactt	tcaccagcgt	5520
ttctgggtga	gcaaaaacag	gaaggcaaaa	tgccgcacaa	aagggaataa	gggcgacacg	5580
gaaatggtga	atactcatac	tcttcctttt	tcaatattat	tgaagcattt	atcagggtta	5640
ttgtctcatg	agcggataca	tatttgatg	tatttagaaa	aataaacaaa	taggggttcc	5700
gcgcacattt	ccccgaaaag	tgccacctga	cgtc			5734

<210> 6  
 <211> 30  
 <212> DNA  
 <213> Artificial sequence

<220>

<223> Primer A

<400> 6

cgctgacgtc gtggggccgtg ccagaggccc 30

<210> 7  
 <211> 30  
 <212> DNA  
 <213> Artificial sequence

<220>

<223> Primer B

<400> 7

ggccaagacg tctgcagcat ggggcgtcac 30